

Current Claims Schedule

1 1. (Previously Presented and Currently Amended) Microwave apparatus for measuring  
2 | blood flow rate in a patient's blood vessel, said apparatus comprising;  
3 | an intravascular catheter having proximal and distal ends and containing an inner  
4 | coaxial cable forming a first antenna and an outer cable coaxial with the inner cable and  
5 | forming a second antenna, said first antenna extending axially beyond the second antenna  
6 | a selected distance;  
7 | an extracorporeal control unit including a microwave transmitter which transmits  
8 | signals to the catheter, a microwave receiver which receives signals from the catheter,  
9 | and a processor controlling the transmitter and receiver, said processor including means  
10 | responsive to the timing of the transmitted and received signals for measuring said blood  
11 | flow rate, and  
12 | a diplexer connected between said first and second antennas and the control unit  
13 | for coupling signals from the transmitter to one of the antennas but not to the receiver and  
14 | for coupling signals from the other of the antennas to the receiver but not to the transmit-  
15 | ter.

1 2. (Original) The apparatus defined in claim 1 wherein  
2 | the transmitter transmits signals of a first frequency, and  
3 | the receiver is designed to receive signals of a second frequency different from  
4 | the first frequency.

1 3. (Original) The apparatus defined in claim 1 wherein the diplexer is contained in a  
2 proximal end of the catheter.

1 4. (Original) The apparatus defined in claim 1 wherein  
2 the transmitter transmits signal pulses to said one of the antennas and, each time,  
3 sends a transmit signal to the processor;  
4 the receiver sends a detect signal to the processor each time it detects a signal  
5 from said other of the antennas, and  
6 said processor includes means for determining the elapsed time between the re-  
7 ception of a transmit signal and a subsequent detect signal and means for dividing that  
8 time into the axial distance between said first and second antennas to compute said flow  
9 rate.

1 5. (Original) The apparatus defined in claim 4 wherein the control unit also includes a  
2 display device controlled by the processor for displaying the flow rate.

1 6. (Original) The apparatus defined in claim 1 wherein the inner coaxial cable is slidable  
2 relative to the outer coaxial cable so as to allow adjustment of said selected distance.

1 7. (Original) The apparatus defined in claim 1 wherein the diplexer is mounted to a  
2 proximal end of the catheter and includes

3           radially spaced-apart inner and outer tubular conductors surrounding a segment of  
4   said inner coaxial cable and connected electrically to said outer coaxial cable;  
5           a tubular side branch extending from said outer conductor;  
6           a branch conductor extending from said inner conductor through said side branch  
7   to form a port;  
8           a short circuit between said inner and outer conductors at a distance from said  
9   branch conductor to form a quarter wavelength stub at the frequency of the signal carried  
10 by the outer antenna.

1   8. (Original)The apparatus defined in claim 7 wherein the inner coaxial cable is slidable  
2   relative to the outer coaxial cable and inner conductor so as to allow adjustment of said  
3   selected distance.

1   9. (Currently Amended) Microwave apparatus for measuring the blood flow in a patient's  
2   blood vessel, said apparatus comprising

3           an intravascular catheter having proximal and distal ends and containing an inner  
4   coaxial cable forming a first antenna and an outer coaxial cable forming a second an-

5 | tenna, said first antenna extending axially beyond the second antenna a selected distance;

6 | ~~and~~

7           a diplexer at the proximal end of the catheter, said diplexer having radially  
8   spaced-apart inner and outer conductors, said inner conductor snugly receiving the inner  
9   coaxial cable and the inner and outer conductors being connected electrically to the outer

10 coaxial cable, said outer conductor having a tubular branch oriented substantially 90°  
11 relative to the inner conductor and said inner conductor having a connection extending  
12 through said branch and being spaced from corresponding shorted ends of the inner and  
13 outer conductors to form a quarter wave stub at the frequency of the signal carried by the  
14 second antenna; and  
15 a control unit including a microwave transmitter which transmits signals via the  
16 diplexer to the catheter, a microwave receiver which receives signals via the diplexer  
17 from the catheter and a processor controlling the transmitter and receiver, said processor  
18 including means responsive to the timing of the transmitted and received signals for  
19 measuring said blood flow rate.

1 10. (Original) The apparatus defined in claim 9 wherein the inner coaxial cable is slidable  
2 lengthwise relative to the outer coaxial cable and an inner conductor so as to allow ad-  
3 justment of said selected distance.

1 11. (Original) The apparatus defined in claim 9 wherein the inner coaxial cable has an  
2 open-ended tubular inner conductor which extends the length of the catheter.

1 12. (Currently Amended) Microwave apparatus for measuring blood flow in a patient's  
2 blood vessel, said apparatus comprising  
3 an intravascular catheter having proximal and distal ends;  
4 a diplexer at the proximal end of the catheter, said diplexer including

5                   a radially outer tubular conductor having a tubular side branch, and  
6                   a radially inner tubular conductor spaced from the outer conductor and  
7   having a connection extending through the side branch of the outer conductor to the out-  
8   side to form a first port, said inner and outer conductors having proximal ends which are  
9   short circuited to form a quarter wave stub between said proximal ends and the side con-  
10   nection of the inner conductor;

11                a first antenna at the distal end of the catheter, said first antenna including radially  
12   inner and outer electrically insulated tubular conductors connected electrically to the re-  
13   spective inner and outer conductors of the diplexer; and

14                a second antenna at the distal end of the catheter spaced axially beyond the first  
15   antenna, said second antenna including a coaxial cable having an inner conductor and  
16   which extends through the inner conductor of the diplexer to the outside to form a second  
17   port; and

18   a control unit including a microwave transmitter which transmits signals via the  
19   diplexer to the catheter, a microwave receiver which receives signals via the diplexer  
20   from the catheter and a processor controlling the transmitter and receiver, said processor  
21   including means responsive to the timing of the transmitted and received signals for  
22   measuring said blood flow rate.

1   13. (Original) The apparatus defined in claim 12 wherein the coaxial cable is slidable  
2   within the inner conductors of the first antenna and diplexer to adjust the axial distance  
3   between the first and second antennas.

1 14. (Original) The apparatus defined in claim 12 wherein the inner conductor of the co-  
2 axial cable of the second antenna is an open-ended tube adapted to slidably receive a  
3 guide wire.

1 15-18. (Cancelled)